GOVERNMENT OF INDIA.

REVENUE AND AGRICULTURAL DEPARTMENT.

WEATHER SUMMARY FOR JANUARY, 1889.

Simla, the 13th February 1889.

As pointed out in last month's report, January is usually an unsettled month in Northern India. This is due to the occasional occurrence of cold-weather storms, the chief characteristics of which were stated in last month's report. The great majority of these storms belong to two classes. The first class comprise those depressions which first show themselves in the north or north-west of the Punjab. They are frequently deep depressions, but are generally short-lived, and are either stationary or move slowly in a south-east direction along the Himalayas for a short period and then fill up. They give more or less heavy rain to the Punjab and snow to the adjacent mountains, but their effects are chiefly confined to Upper India. The second class of storms include the usually much shallower depressions, which appear on the north-west frontier in Upper Sind, and which probably, in the great majority of cases, advance from Beluchistan. As compared with the previous, they are frequently remarkably persistent and traverse the whole breadth of the Peninsula, passing sometimes into Upper Burma, where they fill up or disappear. Occasionally small depressions also form in Central India or the Central Provinces. These are generally very shallow and are less persistent than the previous, but usually march in the same general east-south-easterly or easterly direction, and disappear after an existence of one to three days. They sometimes give moderately heavy rain to Central India, the Central Provinces, and Behar. Several disturbances have occurred during the month, the majority of which were unusually feeble, and gave little rain in Upper India. The two last disturbances of the month were however large and gave fairly general rain to the greater part of Northern India, but were chiefly remarkable as being examples of double storms, that is, of the combination of a storm of the first and of the second class, originating separately and co-existing as independent disturbances for some days.

At the commencement of the month fine weather with normal anti-cyclonic conditions prevailed in Upper India. On the morning of the 4th a small and very shallow depression, similar to those of the preceding month, appeared in Sind. It moved eastwards during the day, filling up with its advance, but caused some disturbance in the Punjab Himalayas on the 5th, which gave light to moderate snow to the higher elevations. Anti-cyclonic conditions were again established in Upper India on the 6th and continued until the 8th. Weather was slightly unsettled during this period in Southern India, and many thunderstorms occurred in Southern India, which gave light to moderate rain in South Madras, Mysore and Ceylon, on the 6th, 7th and 8th. The barometer began to fall briskly on the afternoon of the 8th in Upper Sind and Beluchistan, and a very shallow depression was formed on the 9th, which followed the same course as the previous disturbance and gave moderately heavy snow to the Punjab Himalayas on the 10th, and brought the snow line down to below 9,000 feet. The weather continued somewhat disturbed in Northern India for three days longer, and light showers fell at the hill stations on the 12th, and in Behar, Chutia Nagpore and Central Bengal on the 13th. Pressure increased steadily until the 17th, when very strongly marked anti-cyclonic conditions, with fine clear, cool weather and strong westerly or north-westerly winds, prevailed over the whole of Northern India. The highest pressures of the month were recorded on the morning of the 17th, the absolute maximum being 30·38" at Peshawar. No change of importance occurred until the 22nd, when the barometer fell briskly in North-Western India. The disturbance then initiated differed considerably in character from the previous. There were two separate areas of disturbance in which the barometer fell rapidly, and more or less general rain was received. The first included the Punjab Himalayas and adjacent plains from Sealkot to Roorkee, and the second comprised the greater part of Rajputana and Indore. The disturbance in the Punjab passed away after giving moderate snow in the hills on the afternoon of the 23rd and light showers in the adjacent plains. That which originated in Rajputana drifted during the next two days eastward into East Bengal and Burma, and gave moderate general rain to the North-Western Provinces, Central India, and light local showers in Behar, Bengal, and Assam. A short interval of fine weather followed until the afternoon of the 27th, when the first large and important cold-weather storm of the present season was initiated. It was like the previous a double disturbance. It consisted in part of a shallow depression which passed into Sind from Beluchistan on the 28th and advanced in an east-south-east direction across the head of the Peninsula during the next three days into Upper Burma, to which it gave cloudy weather on the 1st February. It apparently filled up very slowly in that area and gave low pressure in Burma until the 5th. The appearance of this depression in Sind on the 28th was followed on that day by a very rapid fall of the barometer in the North Punjab and the formation of an independent deep depression, the centre of which was to the north of Rawalpindi and Peshawar on the morning of the 29th. It intensified considerably during the day and marched slowly to the south-east along the hills, to which it gave very stormy weather and heavy snowfall during the next forty-eight hours. A very rapid rise of the barometer set in on the 31st, and the depression filled up very rapidly. This deep depression very largely modified the distribution of pressure over the whole of North-Western and Central India, and obscured the shallow depression in Central India on the 29th and 30th; but with the disappearance of the former on the 31st, the latter again became clearly marked and formed the chief feature of the weather during the next two days. The double disturbance gave a large general and much needed supply of rain to the greater part of Northern India, including the Punjab, Rajputana, Central India, the North-Western

Pressure.—The mean pressure of the month for the whole of India was ·017 above the normal. The excess was greater at the hill stations than at the adjacent plain stations. Relatively to this general state pressure was in defect over the whole of Northern and Central India (with the exception of the North Punjab). The line of greatest relative depression was defined by the following stations :—

	Relative deficiency.
Deesa	·020″
Nowgong	·015″
Allahabad	·016″
Patna	·018″
Dhubri	·019″

A second axis of depression apparently ran along the Himalayas, being indicated by the negative anomalies at the following stations :—

Gorakhpur	·021″
Mooltan	·012″
Ludhiana	·027″

Pressure was relatively to the general state in excess over the whole of the Peninsula. The relative excess was greatest at the following stations, *viz* :—

Belgaum	+·022
Bellary	+·023
Salem	+·029
Trichinopoly	+·020
Madura	+·021
Cochin	+·025

A reference to last month's report will show that the more prominent features of the pressure variations of the month of January were identical in character with those of the previous month, but were smaller in amount. It will thus be seen that the larger pressure abnormal variations or anomalies have been remarkably persistent for some time, and the probable distribution of the cold-weather rains of the months of January and February, based on this strongly marked distribution of pressure given in last month's report, has been fully confirmed up to the present date.

Temperature.—In consequence of the unusual prevalence of anti-cyclonic conditions, and the absence of large cold-weather storms until the end of the month, the mean temperature was considerably in excess. The following table gives the variation of the mean maximum, minimum and daily temperatures from their normal values in different districts :—

	Maximum. °	Minimum. °	Mean. °
Burma	+1·8	+0·5	+1·1
Bengal	+1·7	+1·7	+1·7
North-Western Provinces	+2·3	+2·0	+2·1
Punjab	+1·0	+0·7	+0·8
Berars	+5·2	+2·2	+3·7
Central Provinces	+5·0	+3·0	+4·0
Central India and Guzerat	+3·4	+3·0	+3·1
Rajputana	+2·3	+1·5	+1·9
Bombay	+3·0	+0·1	+1·5
Madras	+0·5	—1·0	—0·2

Hence the figures have been most prominent in the Central Provinces and Central India, where the mean temperature of the month was four degrees above the normal.

One of the more remarkable features of the month has been the frequent inversion of the normal temperature relations between the plains and hill stations. On about eleven nights of the month the lowest night or minimum temperatures of the hill stations were very considerably higher than those of the neighbouring stations in the Gangetic plains. It will suffice to give one example—

Hill Stations.	Minimum or lowest Temperature of night of 2nd January. °	Plain Stations.	Minimum or lowest Temperature of night of 2nd January. °
Murree	49·3	Rawalpindi ..	36·9
		Dera Ismail Khan ..	36·9
		Sealkot	41·1
Simla	48·4	Lahore	37·2
		Sirsa	39·2
Ranikhet	50·0	Delhi	40·1
		Roorkee	36·6
		Meerut	39·0
		Bareilly	39·8
		Agra	43·6
		Allahabad	42·7
		Benares	41·9
		Patna	46·9
		Calcutta	48·8

These figures show that not only was the night temperature of the hill stations from 8° to 13° higher than that of the adjacent plains, but that it was actually higher than over the whole Gangetic plain down almost to the sea in Bengal.

This, it may be added, is one of the most remarkable examples that have occurred during recent years of the peculiarity of the weather at the hill stations in the months of December and January, *before the occurrence of heavy snow.* The only satisfactory explanation appears to be that the high night temperatures are due to an indraught of comparatively warmer air to the hills from the strata above the plains at the level of the hills.

Rainfall.—The preceding remarks have stated the conditions under which the rainfall of the month has occurred. The cold-weather rainfall of the present season up to date has been abundant over the whole of Northern India, but the first heavy rainfall of the season occurred somewhat later than usual. The rainfall of the month has been especially abundant in the Punjab, North-Western Provinces, Behar and Northern Bengal, which areas have received at least double their normal amounts. The excess is relatively greatest in Behar and North Bengal. The Central Provinces, Berar, Khandesh, Guzerat and Orissa which usually receive some light showers were practically rainless during the month. No rain fell in Lower Burma and the Konkan. In the remaining districts, including Rajputana, Assam, Lower Bengal, Malabar, Mysore and Madras, the rainfall of the month was not large in amount, and was either normal or slightly in defect.

The following table shows the actual average rainfall and the normal rainfall of the month of the twenty-one districts into which the country is divided so far as it is indicated by the telegraphic reports of a few stations in each district :—

Districts.	No. of Stations.	Normal Average rainfall in January.	Actual average rainfall in Jan. 1889.	Difference from the average in Jan. 1889.
Punjab, West	7	1·48	3·04	+1·56
" East	4	1·58	2·68	+1·10
North-Western Provinces, Trans-Gangetic ..	7	1·32	2·46	+1·11
" " Cis-Gangetic ..	3	0·67	0·49	—0·18
Behar	2	0·55	1·40	+0·85
Northern Bengal	2	0·34	3·18	+2·84
Assam, Cachar	3	0·78	0·49	—0·29
Lower Bengal—Chutia Nagpur	7	0·36	0·37	+0·01
Orissa, Northern Circars	5	0·25	0	—0·25
Central Provinces, South	7	0·38	0·01	—0·37
Berar—Khandeish	2	0·30	0	—0·30
Rajputana, Central India—Saugor and Nerbudda.	9	0·48	0·30	—0·18
Sind—Cutch	3	0·43	0·64	+0·21
Guzerat	3	0·05	0·04	—0·01
Konkan	4	0·23	0	—0·23
Deccan—Hyderabad	5	0·06	0·01	—0·05
Malabar	5	0·14	0·20	+0·06
Mysore—Bellary	4	0·34	0·42	+0·08
Carnatic	6	0·87	0·44	—0·43
Lower Burma	7	0·09	0	—0·09
Ceylon	1	2·20	6·48	+4·28

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